Appendix 2 – Other Waterbird Issues

- **Taxonomic Treatment of Great White Heron**
- **Wetland Losses by BCR**
- **Contaminants**
- **Beneficial Use of Dredged Material**
- **Depredation Control**

Taxonomic Treatment of Great White Heron

The Great White Heron is currently treated as a polymorphic subspecies (Ardea herodias occidentalis) of the West Indies and extreme south Florida of the Great Blue Heron, with the white morph predominating in Florida Bay and the Florida Keys. The "Wurdemann's" Heron, sometimes thought to be a hybrid form, but more likely a dark morph of the Great White Heron, varies from a typical Great Blue Heron of the southeastern U.S. subspecies (A. h. wardi) by a white head plumage, most along the Lower Florida Keys, to almost being identical to typical Great Blues except for having Great White morphological features (reduced or no occipital plumes, grayer overall plumage, larger overall size, heavier bill), most in Florida Bay and the Upper Keys.

Whether or not typical Great Blue Herons actually nest in extreme south Florida remains unclear, but they do north of Florida Bay and many northern populations winter in Florida Bay while local breeding is underway (ranging from September to February). Whatever the dark plumaged birds are taxonomically that nest in Florida Bay and the Florida Keys, they are mostly segregated from white plumaged birds, sometimes even on the same nesting island. In addition, the results to date that suggest 2-4% of all heron pairs in Florida Bay and the Florida Keys are mixed demonstrates that these taxa at least are not light and dark morphs in same way as found in several species of raptors and possibly Reddish Egrets (for the latter at least in Florida, but see below). In addition, evidence exists that these mixed pairs tend to be relatively late nesters and as of yet the more extreme Wurdermann's form (dark body plumage with white head plumage) has not been known to backcross with either Great Blue or Great White populations and therefore may not be reproductively viable. The mechanism that might explain why segregation occurs between Great White and Great Blue Herons is not known, but the evidence points to Great White Heron being a full species and certainly not a morph and

possibly nor a subspecies of Great Blue Heron. Studies in the relative timing of nesting between sympatric forms, genetics, morphology, and foraging between these two taxa seem warranted, especially since the Great White Heron, is among the highest priority long-legged wading taxa in North America and would be better highlighted as such if it legitimately was treated as a full species.

The American Ornithologists' Union's (AOU) 1973 reclassified the Great White from a "good" biological species to a subspecies, restricted in breeding distribution in some treatments to only extreme south Florida and in other treatments to include the all the polymorphic populations of the West Indies and islands bordering the Caribbean Sea. However, both popular and technical treatments subsequently have led to the widely held perception that Great White Heron is simply a white morph not unique in any other way from the continentally widespread and common Great Blue Heron. This in turn has led most recently to conservation efforts in south Florida not recognizing the potentially high vulnerable status this taxon may be in, as well as not recognizing this taxon as a potentially important environmental indicator with its unique trophic status as a top predator in an increasingly degraded environment of south Florida. The 1973 reclassification itself does not support these treatments, but the confusion is understandable given various uses of the term "morph" in taxonomy, the lack of any substantial update to subspecies treatments since the Fifth Edition (1957) Check-List of North American Birds, and how past and more recent evidence could be applied to alternatives to the conventionally applied Biological Species Concept, such as the Phylogenetic Species Concept (PSC). A separate commentary will be provided examining past taxonomic treatments for Great White Heron, attempts to correct the widespread perception that Great White Heron is only a white morph by resurrecting its most recent AOU treatment as at least a subspecies under the Biological Species Concept (BSC), and suggests that the Great White Heron may qualify as a "good" phylogenetic and even a biological species. Recommendations are provided for future monitoring and research to help resolve issues separating treatment of this taxon between the BSC and PSC and to determine the appropriate level of attention Great White Heron should receive from a conservation perspective.

Wetland Losses by BCR

Section based on information and analysis prepared by Tom Dahl, U.S. Fish and Wildlife Service, Branch of Habitat Assessment

The loss of estuarine and freshwater emergent wetlands is likely the most serious threat to waterbird populations in the Southeast U.S. Region. Historically supporting a large percentage of these habitat types in entire United States, huge declines have occurred for the past three decades. Data are available from several sources regarding wetland losses in the U.S. These losses are summarized for BCRs in the Region in Table 1 (below).

Emergent estuarine wetlands in BCR 31 (Peninsular Florida) declined by BCR 31 - Peninsular Florida by 1,600 acres between 1974 and 1998, primarily due to urbanization. There were an estimated 251,500 acres of estuarine emergents in BCR 31 , accounting for approximately 6.4 percent of the total estuarine emergent wetland area in the conterminous U.S. By 1998, salt marsh vegetation made up less than one third of the estimated intertidal (saltwater) wetlands in Florida. Other types included mangroves, non-vegetated beaches, shores, bars, shoals and flats. Estuarine salt marsh was lost to deepwater where the vegetation was scoured or buried by sediments, or was washed away by rising water or turbulent wave action. However, the dominant factor resulting in a decline of salt marsh wetland was the conversion to estuarine shrubs primarily along the Gulf coast in Sarasota, Charlotte, Lee, Collier, Monroe and south Dade counties. In 1998, the average size of estuarine emergent wetland in Peninsular Florida was 22.9 acres. A continual downward trend in acres of estuarine emergent wetlands has been documented since the 1950s.

Freshwater emergent wetlands in BCR 31 account for 10.5 percent of the all freshwater emergent wetland area in the conterminous U.S. Freshwater wetlands declined by more than 10% between 1974 and 1998. This was the largest decrease of any wetland category sampled within the state. Agriculture was responsible for some of the emergent wetland loss to upland land uses. An estimated 98,400 acres of emergent wetlands were lost to upland agriculture (gross loss). Of the 98,400 acres lost, 60,100 acres of agricultural upland elsewhere in the state, were converted to emergent wetlands to offset some of the losses (wetlands gains). Wetland restoration, creation, land

retirement or set aside programs were responsible for many of these changes in land use. A net loss of 38,300 acres of emergent wetland was attributed to agricultural land use. That accounted for 63 percent of the emergent wetland lost to upland. There was also substantial conversion of freshwater emergent wetland to shrub wetland between 1985 and 1998. An estimated 286,900 acres of emergent wetlands were re-classified as shrub wetlands. Historically there have always been small conversions between wetland types (i.e. shrub to emergent and emergent to shrub) based on duration and intensity of flooding or frequency of wildfires. Changes of the magnitude that occurred in Florida between 1985 and 1998 were indicative of prolonged periods of drought that allowed woody plants to become established in emergent wetlands, or the invasion of shrubs such as Brazilian pepper or *Melaleuca*.

BCR 26 (the Mississippi Alluvial Valley) was defined for the purposes of this analysis as not extending south to include the extreme lower Mississippi River Delta and mouth as it enters the Gulf of Mexico. Therefore there were no estuarine wetland types included for this BCR. However, freshwater emergent wetlands in this BCR account for about 2.6 percent of all freshwater emergent wetland area in the conterminous U.S. and declined by more than 6% between 1983 and 1998. It was estimated that 85 percent of these losses between 1983 and 1990 were due to agricultural conversion. Land uses changed during the 1990s and some of the emergent wetlands losses in BCR 26 were offset by clear cutting forested wetlands. This re-classified many areas as emergent (or shrub) wetland, but it is doubtful they will remain as emergent marshes as these forested areas are re-planted to tree species. Other emergent wetlands in this region were lost to agricultural development. There are an estimated 4.3 million acres of land in some type of cultivated rice production (either land in dry crop rotation or flooded for rice) within BCR 26. Small sections of emergent marshes were “squared off” as portions of agricultural fields or wet sites that had been partially drained were completely drained for agricultural production.

In 1985, there were an estimated 361,600 acres of estuarine emergent wetland in BCR 37 (Gulf Coast), primarily concentrated along the upper and mid-coast (Sabine Lake to Aransas Bay). These wetlands declined by about 850 acres per year between

1985 and 1992. Losses resulted primarily from the conversion to estuarine subtidal bays; palustrine emergents; lacustrine reservoirs; urban and other types of development. The loss of estuarine marsh to open subtidal bay occurred primarily between Freeport and Port Arthur and was associated with the submergence (drowning) and erosion of wetlands probably due to faulting and land subsidence resulting from the extraction of underground water and oil and gas. Loss of estuarine intertidal wetlands to upland "other" and conversion to palustrine emergents resulted partly from the construction of dredge spoil compartments along the Gulf Intracoastal Waterway and other ship channels, and also from construction of roads, levees, etc. that altered original tidal hydrologic characteristics.

BCR 37 supported 616,400 acres of freshwater emergent wetland in 1985, which sustained an average annual net loss of 6,360 acres. This was the largest acreage change for any wetland category in this geographic area. On the upper and mid-coast, conversion of emergents to scrub-shrub resulted from invasion by the introduced Chinese Tallow-tree. While losses of emergents to lacustrine open water were due to reservoir construction. The loss of freshwater wetlands to agriculture was widespread along the coast and was greatest in Chambers, Harris, Brazoria, Fort Bend, Wharton, Matagorda, and Refugio Counties where there were an estimated 1,742,000 acres of land in some type of cultivated rice production (either land in dry crop rotation or flooded for rice). Freshwater wetlands, particularly palustrine farmed and palustrine emergents, were also lost to urban and rural development, especially in the Houston and Beaumont-Port Arthur areas. Loss to rural development was greatest in Orange, Jefferson, Chambers, Galveston, Harris, Brazoria, and Nueces Counties

Estuarine emergent wetlands suffered substantial losses between 1974 and 1987 in BCR 27 (Southeastern Coastal Plain), declining by over 5 percent. These losses were due to coastal development in Virginia, the Carolinas, the panhandle of Florida and losses sustained by coastal marshes in Louisiana. By 1997, the remaining estuarine emergent wetland in BCR 27 made up 69.8 percent of the total estuarine emergent area in the conterminous U.S. Estuarine wetlands have been declining steadily since the mid 1980s. Although there continues to be development pressure in certain regions, overall, estuarine wetlands benefit from Federal and State protection measures. The most common types of

wetland changes observed since the late 1990s have been associated with coastal erosion, storm surge or deposition of sediment in coastal areas.

Although Hefner et al. (1994) indicated freshwater emergent wetlands in BCR 27 showed a net increase from the mid 1970s to the mid 1980s, that analysis included data from the states of Louisiana, Mississippi, Arkansas and all of Florida. Losses of freshwater emergents were offset by conversion of large tracts of forested wetland to emergent wetlands. This analysis has excluded the Mississippi Alluvial Plain portion of AR, LA and MS as well as Peninsular Florida and indicates freshwater emergent wetlands sustained substantial losses during this time period. Throughout the 1990s, freshwater emergent wetlands continued to be one of the categories suffering the largest net losses. This was particularly true in the southeastern coastal plain where freshwater emergent wetlands were lost to agricultural development, as well as urbanization. In 1998, freshwater emergent wetland in BCR 27 made up about 7.1 percent of the total freshwater emergent area in the conterminous U.S and the rate of decline was still 1.0 percent per year.

Table 1. Summarized wetland losses by BCR.

BCR 31-Peninsular FL	**1974**	**1984**	**Lost (% Change)**	**1998**	**Lost (% Change)**
Estuarine Emergent	253,100	253,000	100 (<-0.1)	251,500	1,500 (-0.6)
Freshwater Emergent	3,007,100	2,897,100	110,000 (-3.8)	2,636,900	260200 (-9.9)
BCR 26-MS Alluvial Valley	**1983**	**1990**	**Lost (% Change)**	**1998**	**Lost (% Change)**
Freshwater Emergent	702,300	683,200	19,100 (-2.8)	658,400	24,800 (-3.8)
BCR 37-Gulf Coast	**1985**	**1992**	**Lost (% Change)**	**1998**	**Lost (% Change)**
Estuarine Emergent	361,600	355,600	6,000 (-1.7)	352,000	3,600 (-1.0)
Freshwater Emergent	616,400	571,900	44500 (-7.8)	552,800	19,100 (-3.5)
BCR 27-S.E. Coastal Plain	**1974**	**1987**	**Lost (% Change)**	**1998**	**Lost (% Change)**
Estuarine Emergent	2,911,600	2,767,500	144,100 (-5.2)	2,752,400	15,100 (-0.5)
Freshwater Emergent	2,122,200	1,951,300	170,900 (-8.8)	1,775,400	175,900 (-9.9)

Contaminants

Organochlorine Pesticides

The organochlorine pesticides include DDT and its breakdown products (DDE and DDD), toxaphene, aldrin, dieldrin, heptachlor, chlordane, mirex, lindane and other compounds. Valuable recent reviews of the avian toxicology of these compounds are available (Blus 1996, 2003, Peakall 1996, Wiemeyer 1996). They range in toxicity from extremely toxic (e.g. endrin) to only slightly toxic (e.g., DDT and lindane), and DDT has the well-known sublethal effect of impairing calcium metabolism in the shell gland of the female (which in some species led to eggshell thinning severe enough to cause egg breakage during normal incubation). Most of these pesticides were banned decades ago due to their persistence in the environment, strong tendency to bioaccumulate in wildlife, and toxic effects on wildlife. While concentrations region-wide continue to decline following the ban of these compounds (Schmitt 1998), they remain a concern for waterbirds in the Southeast at historical manufacturing sites and high-use areas (typically associated with produce or cotton) due to their persistence.

A much publicized (Williams 1999) but rare event was the mortality of over 20 species of birds in re-flooded agricultural fields north of Florida's Lake Apopka. In the fall of 1998 through the spring of 1999, natural resource managers at the site pointed to dieldrin, toxaphene, DDT and DDE as the primary causative factors in the death of hundreds of birds which ate fish which had bioaccumulated these compounds from soils after the area was flooded. The American white pelican, wood stork, and great blue heron were most affected and accounted for 80% of all reported deaths. In addition to mortality, hundreds of additional birds ingested quantities of pesticides that potentially impacted their future reproductive output (Anonymous 2004).

Most organochlorine pesticides are no longer in use, and the only practical management at this time is cognizance of highly contaminated areas, impacts of manipulating these areas, and potential consequences of making them attractive to wildlife. Because of the tremendous importance of wetland restoration in the Southeast for wildlife conservation, a tiered approach of site-specific risk assessment is recommended so projects can proceed. Managers should 1) investigate prior cropping history and pesticide use for a parcel of interest; 2) analyze soil for compounds identified

by that review if warranted based on the pesticide use history; and, 3) conduct simple avian risk assessments of the soil chemistry data by modeling expected concentrations in waterbird food and comparing those to avian effects concentrations. Wildlife toxicologists and risk assessors can provide this assistance, including the Environmental Contaminants staff of the U.S. Fish and Wildlife Service field offices throughout the region. Results of a risk assessment can be used to inform managers of potential impacts so that appropriate techniques and monitoring are employed.

Petroleum

Oil and other petroleum products enter the environment from many permitted releases as well as accidents. These products are typically complex mixtures of many individual hydrocarbon compounds and associated chemicals. While chronic low-level oil pollution exists in many waterways, the primary concern for waterbirds are sources sufficient to produce floating slicks that piscivorous birds must pass through to forage. These sources include petroleum extraction, refinement, and waste disposal sites as well as spills from pipeline, over-water, and over-land transport. Oil has caused mortality of many species of waterbirds in the southeast, most frequently loons, pelicans, and wading birds in numbers between a few to about a hundred per event.

Impacts to birds result primarily from external exposure through loss of weatherproofing and insulation properties of feathers. This often leads to hypothermia, exhaustion, starvation and drowning (Rocke 1999). Oil is also an irritant to eyes, the oral cavity and gastrointestinal tract and can cause systemic injuries upon ingestion. Of particular concern for waterbirds is the avian egg's particular vulnerability to oil; even quantities as small as one or two drops can kill the developing embryo (a particular concern in nesting colonies of waterbirds during the incubation period when small amounts of oil on feathers of adults can be harmful to eggs) (Jessup and Leighton 1996, Albers 2003).

Prevention of exposure should be the focus of addressing oil on the local level. The Oil Pollution Act of 1990 required Area Contingency Plans to be developed throughout the U.S., and there is a component of each plan dedicated to identification of sensitive habitats and species at risk of oiling. Work on the local level to get important

waterbird habitat (especially the location of densely populated nesting colonies) identified in these plans is recommended so that they will be known to those responsible for oil spill planning and actual responders. In North Carolina for example, colonial waterbird sites identified by natural resource managers are noted on response maps and identified as among the highest priorities for response planning. Also, major oil and hazardous materials shipping, storing, and handling facilities are required to develop Facility Contingency Plans; natural resource managers have the ability to help ensure that important waterbird habitats are identified as priorities for protection in these plans too. The Marine Safety Offices (http://www.uscg.mil/vrp/maps/msomap.shtml) of the U.S. Coast Guard are responsible for coordinating this effort.

Clean-up of oil once released and hazing of wildlife away from spilled oil are important management tools. At some production facilities, oily wastes stored in evaporation lagoons or oil / water separation pits can harm wild birds. Oil pits are also used to contain spilled oil and can be an attractive nuisance to waterbirds. Solutions to the danger posed by oil pits include removal or remediation of pits, use of closed containment systems for oily wastewaters, use of effective bird deterrents or exclusionary devices such as netting, and clean-up of accidental spills (Ramirez 1999).

Mercury

Mercury, like all heavy metals, is a naturally occurring element, but it can become significantly enriched through anthropogenic actions including coal combustion, waste incineration, chemical production, and production and disposal of mercury-containing equipment (batteries, switches, manomoeters, barometers, thermometers). In the Southeast, pulp and paper mills and chlor-alkali plants are important historic sources (mercury is typically not a part of their processes now) with residual contamination present at many of these facilities. In addition to these sites, atmospheric transport of airborne mercury is a nearly ubiquitous source of this element in aquatic systems. Because it is biologically nonessential, does not degrade like organic compounds, tends to accumulate in aquatic food chains, and is capable of a variety of toxic impacts to birds at concentrations known to occur in the environment, mercury is an important contaminant for the waterbird manager’s consideration.

Unlike the new generation pesticides and oil, avian die-offs from mercury are unusual. Mercury is more a concern from accumulation of concentrations that can impair nervous system function, decrease productivity, and alter immune function. Dietary concentrations as low as 0.5 parts per million (ppm)-dry weight (~0.1 ppm wet weight) have been associated with adverse reproductive impacts to sensitive avian species (Heinz 1979). Because this concentration is frequently met or exceeded in fish throughout the southeastern U.S., fish-eating birds have been a focus of mercury impact assessment. Nowhere has this been investigated more than the Everglades ecosystem.

Evaluation of the significance of mercury to waterbirds in the Everglades has included monitoring, feeding studies, and risk assessments. The simplest approaches have compared measured mercury concentrations in fish or bird tissues to literature-derived estimates of avian hazard levels of mercury. Several of these approaches have indicated risk to waterbirds (Sundlof et al. 1994, Beyer et al., 1997, Sepulveda et al. 1998, Duvall and Barron 2000). Perhaps the most compelling indication of risk comes from work where exposure and effects were determined through feeding studies to elucidate the great egret's particular sensitivity to mercury. Captive great egrets on a fish diet augmented with mercury at 0.5 ppm wet weight had reduced appetite and growth, and altered immune function and behavior (Bouton et al. 1999, Spalding et al. 2000a, 2000b); this concentration in the experimental diet is similar to forage of wild egrets in the Everglades (which averaged of 0.41 ppm wet weight in one estimate based on samples collected from 1993 to 1996) (Frederick et al. 1999). Although there are important atmospheric sources of mercury on global and regional scales, analyses of waterbird tissues in the Everglades reveals mercury concentrations in feathers that are very high relative to other areas and which tend to accumulate with growth of feathers of nestlings, indicating important local mercury sources and enrichment (Sepulveda et al. 1999). While this is a concern, mercury concentrations in south Florida waterbirds appear to have peaked in the late 1980's and early 1990's following a pronounced increase in concentrations beginning in the 1970's (Frederick et al. 2004). Recently, several investigators have documented strongly declining mercury concentrations in great egret eggs and feathers in the freshwater Everglades which indicate a significant decline

in mercury availability in the wetland food web since the mid-1990s, possibly because of decreased local inputs (Rumbold et al. 2001, Frederick et al. 2002).

Because mercury does not degrade, clean-up of existing sites with elevated concentrations and prevention of additional inputs are the only practical control mechanisms. Managers should consider local mercury sources and existing concentrations at important waterbird habitats. Important local sources with the potential to impacts waterbird habitat should be evaluated for remediation. Because accumulation of mercury in animals is at least temporarily enhanced when terrestrial habitats are flooded, consideration of levels in soils should be evaluated prior to impounding water for waterbird habitat (Franson 1999b). The format for considering this issue is identical to that outlined above for evaluating potential pesticide impacts at wetland restoration sites.

Lead

Lead is also a biologically non-essential heavy metal. While it has many sources in the environment, including fossil fuel combustion, vehicle emissions, and industrial effluents (Pattee and Pain 2003), lead objects such as bullets, shot, and fishing tackle that are the main concern for birds. Once ingested, these large doses of lead are degraded by the acidic conditions of the gastrointestinal system leading to chronic exposure of high lead concentrations and disruption of many physiological systems. The prohibition of lead shot for waterfowl hunting in the United States, phased-in with the start of the 1987-88 hunting season, certainly reduced exposure to waterbirds, but lead shot ingestion remains the primary source of elevated lead exposure and poisoning in most birds (Scheuhammer et al. 1996, Franson 1999). Exposure persists due to the large stores of lead in wetland and shallow open water habitat from decades of lead shot use, continued deposition in uplands and wetlands from current permissible uses (upland game bird hunting and target shooting), and noncompliance with regulations. Rails and coots are among the waterbird species at most risk from shot ingestion (but they are far less at risk than waterfowl) although lead poisoning has affected almost all waterbird species (Franson 1996, 1999).

Another source of ingestible lead items that have poisoned waterbirds is fishing gear such as split shot, jig heads, and sinkers (Scheuhammer et al. 1996, Franson et al. 2003). While this is less of a problem on the wintering grounds of the Southeast estuarine and marine environments than the northern breeding lakes, loons, brown pelicans and double-crested cormorants have been affected by ingestion of lead fishing tackle in our region (Franson 1999, Franson et al. 2003).

Lead objects in soils and sediments may require tens or hundreds of years to breakdown, dissolve or be buried under cleaner materials. Accordingly, minimizing inputs is advisable. Three management approaches should be considered for important waterbird habitat with regard to lead objects that can harm waterbirds. First, encouraging use of nontoxic shot and fishing materials is advisable. While nontoxic shot is mandatory for waterfowl and coot hunting, the other shot options (bismuth-tin, steel, iron-carbon, tungsten-bronze, tungsten-iron, tungsten-matrix, tungsten-nickel-iron, tungsten-polymer, tungsten-tin-bismuth, tungsten-tin-iron-nickel) and fishing tackle options can certainly be promoted as viable options to lead materials for nonwaterfowl hunting, target shooting, and fishing. Second, identification of problem areas either from avian mortality reports or knowledge of historic and current lead shot use is advisable. Third, in areas of known high shot density where mortality has been a problem, clean-up or management options can be evaluated. Management to plow or till shot deeper into the soil profile has worked to reduce exposure to some ground-gleaning species. Flooding to eliminate pathways for waterbird foraging can also work, but this may lead to enhanced exposure to waterfowl using these areas. Some efforts continue on regional and national scales to reduce use of lead fishing sinkers and lead shot in nonwaterfowl hunting.

Site-specific Pollutant Identification

A region-wide review of important pollutants like this will cover issues that may not be important locally as well as miss issues that may be important locally. Environmental risk assessors, toxicologists and geographical information database specialists can help waterbird managers identify and prioritize issues at the local scale of important waterbird sites. A suggested approach begins with an inventory of known or suspected pollutant sources in the airshed and watershed of interest. This is readily

accomplished by examining existing databases and files maintained by state and federal natural resource management agencies. For example, the U.S. Environmental Protection Agency's *Envirofacts Database* and some state-level counterpart services allows site-specific queries of many individual databases related to active air and water waste discharge permits, active and abandoned solid or hazardous waste facilities, and hazardous waste generators, transporters, and disposers including the following:

National Pollutant Discharge Elimination System Sites (surface water discharges)
Air Facility System Sites (permitted discharges to air)
Toxics Release Inventory (chemical release data for certain industries)
National Priorities List (Superfund Sites)
CERCLIS Sites (known and suspected unregulated waste sites)
Inactive Hazardous Waste Sites
Old Landfills
Active Solid Waste Permits (landfills, incinerators, etc)
Resource Conservation and Recovery Act Sites (waste transport, storage, and disposal)
Sewage Sludge Land Application Sites
Registered Concentrated Animal Feeding
Underground Storage Tanks

When a database search is combined with a site reconnaissance of the important bird area and interviews with air, water, and waste regulators at the state level, an inventory of waste sources of concern can be generated. This can be the basis for a discussion with wildlife toxicologists on the need for any further actions.
In general, a lack of pollutant sources from this screening would indicate a low need for aggressive site characterization. Likewise, any follow-up work needed would be guided by specific issues from this inventory.

Follow-up work may include review of monitoring data for facilities identified by the inventory or collection of exposure data through new monitoring. Ecological risk assessment is a recommended method for assessing the threat of individual or

combinations of chemical stressors to waterbirds (Rattner 2000), and technical assistance on pollution issues and risk assessment is available through several sources. The U.S. Fish and Wildlife Service typically has one or more Environmental Contaminants Specialists in each of its Ecological Services field offices (http://southeast.fws.gov/es/ndxeso.htm) in the southeastern U.S. Contaminants Specialists can provide assistance in risk assessment, monitoring, and planning. Academic institutions, particularly those with wildlife management programs and toxicology extension specialists, may have services available to help with local site evaluation. The U.S. Geological Survey's Cooperative Fish and Wildlife Research Units (http://www.coopunits.org/About_CRU) provide technical assistance and consultation to parties who have interests in natural resource issues; they can be a liaison to others in their home universities with expertise on contaminant assessment. Technical assistance is also likely available though state natural resource management agencies.

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Table 2. Toxicity of some of the contaminants reviewed here.

Compound	Class[1]	Mallard Acute LD50 (mg/Kg)[2]	Toxicity Category[3]
aldicarb	CB	3.4	Extremely toxic
carbaryl	CB	>2,500	Slightly toxic
carbofuran	CB	0.40	Extremely toxic
chlorpyrifos	OP	76	Highly toxic
diazinon	OP	3.9	Extremely toxic
ethoprop	OP	13	Extremely toxic
famphur	OP	10	Extremely toxic
malathion	OP	1,485	Slightly toxic
temephos	OP	79	Highly toxic
aldrin	OC	520	Moderately toxic
chlordane	OC	1,200	Slightly toxic
DDT	OC	>2,200	Slightly toxic
Dieldrin	OC	381	Moderately toxic
Endrin	OC	33	Extremely toxic
Heptachlor	OC	>2,000	Slightly toxic
Lindane	OC	>2,000	Slightly toxic
Mirex	OC	>2,400	Slightly toxic
Toxaphene	OC	71	Highly toxic

[1] CB = carbamate, OP = organophosphorus, OC = organochlorine

[2] LD_{50}: Concentration, given in a single oral dose, that is estimated to be lethal to 50% of the test population. Units are mg of toxicant per kg body weight).

[3] Relative rating for acute toxicity in avian feeding studies (from Smith 1987):

Extremely toxic ($LD_{50} \leq 40$ mg/kg body weight)
Highly toxic (LD_{50} 41-200 mg/kg body weight)
Moderately toxic (LD_{50} 201-1000 mg/kg body weight)
Slightly toxic (LD_{50} 1001-5000 mg/kg body weight)
Relatively nontoxic (LD_{50} > 5001 mg/kg body weight)

Beneficial Use of Dredged Material

Navigable waterways and channels in the southeastern United States are maintained at appropriate depths primarily through the process of dredging. This is primarily the responsibility of the US Army Corps of Engineers, State Ports, and/or Departments of Transportation. Waterbirds can benefit from dredging operations when dredged material is used to create, restore, or renourish waterbird habitats. Coarse, clean sand can be used to create, restore, or maintain island nesting sites or nesting habitat on beaches, while material not suitable for upland disposal can be used to restore marsh.

One of the greatest benefits to waterbirds from dredging is the creation and maintenance of nesting habitats on islands. Islands created with dredged sand can mimic their natural counterparts and provide excellent habitat for nesting waterbirds. They are often remote and lack mammalian predators, and they are typically only accessible by boat, which reduces, but does not eliminate, the potential for human disturbances. A key advantage of dredged material islands is that they are often higher in elevation than natural islands, which reduces the chances of flooding.

At the same time, there are potential disadvantages of dredged-material islands. Man-made islands require periodic deposits of sand to maintain their size and seral stage, if desired. This is especially true for sites with early succession habitat required by many tern species. Those constructed in open water where an island or emergent shoal did not previously exist can experience rapid erosion. The process of dredging and disposal of dredged material can cause localized increases in turbidity, re-suspend contaminants in sediments, degrade or eliminate submerged aquatic vegetation, and reduce intertidal habitats. Another potential disadvantage is that creating man-made islands could be viewed as mitigation for practices that destroy or degrade stable, natural habitats. This could result in the increased loss of natural habitats over time, especially early succession habitats, unless permanent protection, active management, and periodic renourishment are required. Furthermore, budgetary constraints and increased pressure to place sand on barrier beaches for beach widening and the protection of real estate-- the same sand that once went to remote islands for the benefit of birds-- could jeopardize the future of nesting sites that have historically supported significant populations of waterbirds.

Nevertheless, dredged material islands can and do provide excellent habitat for waterbirds. These man-made islands, together with natural islands and beach nesting sites are essential to waterbirds in the southeastern United States and deserve the utmost in active protection measures and attention from managers.

In planning for the creation or restoration of waterbird nesting sites with dredged sand, one must consider the following: location, dike or not to dike, size, elevation, substrate, and the implementation of a long-term maintenance, management, and monitoring plan.

Location

The presence of mammalian predators or human disturbances will discourage or prevent many species of waterbirds from nesting, especially the colonial species. Islands located close to mainland or another potential mammalian predator source and those easily accessible to people are less suitable for nesting waterbirds. Therefore sites considered for creation or restoration should have a natural or man-made barrier to predators and people. The most effective barrier is open water with a deep channel or tidal flow. A large expanse of open water between mainland or beach and a nesting site will also discourage, but not prevent, visits by people and their pets. At least 1km of open water, preferably with a deep channel and tidal flow, separating a potential nesting site from mainland or other predator source is sufficient to reduce the chance of both predators and people visiting the site.

Another important consideration is the presence of islands or emergent shoals. Islands created in open water where no island or shoal previously existed can experience rapid erosion from tides and storms. This can reduce the useful life of the site. If the source of sand to replenish the site is limited, reducing the chance of erosion is an important concern. Islands created or restored where islands previously existed are usually more stable and offer the best opportunities for creating or restoring nesting sites.

Another important consideration is the history of waterbird use in the area. Waterbirds will likely colonize dredged material islands created or restored in areas with a recent history of nesting activity. Those in areas with no history of nesting activity may require many years before nesting waterbirds colonize the site. Additionally, factors such

has proximity to suitable foraging areas and the stability of foraging areas and prey base may affect the use of a site by nesting waterbirds.

Dike vs. undiked islands

Several studies have compared waterbird use of diked and undiked dredged-material islands (Landin and Soots 1977, Parnell et al. 1997, Parnell and Soots 1979, Soots and Parnell 1975b, Parnell et al. 1986). All have concluded that undiked islands are most suitable for nesting waterbirds. While diked islands will occasionally be used by waterbirds, most ground-nesting waterbird species will avoid nesting on fine substrate typically found in diked islands. Fine substrate and the enclosure of a site within a dike increase the chances of flooding. Furthermore, many species will usually avoid nesting within the dike itself.

There are certainly exceptions. Sites with small dikes or those filled to capacity with coarse "beach quality" sand may be used by nesting waterbirds as they more closely resemble undiked islands than typical diked islands. Waterbirds will sometimes use very large diked disposal areas (>100ha) with open water and patches of emergent marsh and/or woody vegetation suitable for nesting wading birds or marsh birds. Furthermore, diked islands can provide suitable foraging and loafing areas for waterbirds (Landin and Soots 1977).

Islands with out a dike resemble an inverted cone with one or more domes depending on how many times the outflow pipe was moved during disposal. On a typical undiked island, effluent exits the outflow pipe and is allowed to flow unobstructed to the water's edge, which typically results in an island with a gentle slope from dome to water. This is the type of island most preferred by nesting waterbirds.

The Wilmington District of the USACOE has developed a disposal method that results in an island that has features of an undiked island and reduces the impact on surrounding habitats. When used, it can be very successful in creating or restoring waterbird nesting habitat and reducing impacts to surrounding submerged habitats. The method is called "control-of-effluent."

This method of disposal is aptly named because the slurry of water and sand that exits the outflow pipe is channeled to the desired location via small, temporary berms.

The berms are constructed prior to the initiation of dredging and usually surround most of the disposal area. A bulldozer or other earth shaping equipment is used to control the effluent and guide it to the desired area and away from sensitive habitats. The temporary berms are then graded to the desired slope when the pumping of dredged sand has been completed. "Control-of-effleunt" has been (and remains) the standard method used by the Wilmington District for the deposition of dredged sand on estuarine islands since the early 1970's.

Slope

A dredged sand island is rarely a perfect, inverted cone-shaped feature. Most often it consists of a lower drift ridge and swale, an upper drift ridge and swale, a steeper slope leading to the dome, and the dome itself (see Figure 1 from Soots and Parnell 1975b). Soots and Parnell (1975b) defined slope as the rise in elevation from the upper swale to the dome. A gentle slope of 30:1 (a rise of 1 m over a linear distance of 30m) has been recommended for ground-nesting waterbirds (Landin 1986, Chaney et al. 1978).

Ideally, one could place the exact amount of sand on a site to maintain an island's size and slope that would be perfect for nesting waterbirds, and then maintain this size and slope throughout the life of the island. Rarely does this scenario work perfectly.

Most often and especially for restoration of early-succession habitat on an existing island, slope becomes a factor of the maximum allowable (permitted) size of an island or disposal area and the amount of dredged sand available for the site. Therefore flexibility is required to ensure that a site receives a new deposit of dredged sand when needed (if desired) and the site remains suitable for nesting waterbirds. Periodic replenishment with dredged sand is necessary to maintain early succession habitat required by most species of nesting terns and Black Skimmers.

To maintain suitable habitat for ground nesting waterbirds, gentle slopes of 30:1 need to be present on the site. As long as an area with a gentle slope and suitable substrate are present on the dome or at least one side of an island, the island will be suitable for ground nesting waterbirds. Islands with steeper slopes leading to an upper, flat or gently sloping terrace or dome can be suitable as long as the nesting area has the

appropriate substrate. In such as case, the slope leading to the terrace should be no steeper than 10:1. No slope should be greater than 3:1.

Substrate

Substrate comprised of at least 90% sand, often called "beach quality" sand, sand/shell, or sand/gravel is suitable for ground-nesting species and those that require early-succession habitats, such as terns and skimmers. Ground-nesting waterbirds tend to avoid nesting on fine grained substrate, such as that with a high percentage of silt or clay.

The coarse grain composition of substrate on sites where woody vegetation is desirable is less important as long as the site is stable. The stability of a site with fine-grained material can be increased by the deposition of coarse dredged material over the fine substrate (Landin 1986).

Island size, elevation, and shape

Island size and elevation are important considerations. Landin (1986) recommends that islands be no less than 2 ha and no more than 20 ha. Maintenance of bare, sparsely vegetated, or grassy habitats can be more difficult on large islands, especially where maintenance dredging is infrequent or the amount of dredged sand available for an island is limited. Islands with well-developed grassland or shrub thicket habitats may become attractive to predatory birds or mammals, which can discourage ground nesting waterbirds, like terns and skimmers, from nesting. In North Carolina, the mean size of undiked dredged material islands used by nesting terns is 3.4 ha; the mean size of natural islands used by terns is 1.5 ha (NCWRC).

Elevation is also an important consideration. Islands that are low can be susceptible to overwash or partial flooding during late spring or summer storms. Islands that are high in elevation may have slopes that are too steep for nesting terns and the higher elevation substrate may remain unsettled for a long period of time. Landin (1986) recommends one to three meters as ideal elevation for dredged material islands, and that higher elevations may be suitable if the dredged material is coarse sand. The mean elevation of dredged material islands used by terns in North Carolina is 3.4 m and 1.3 m

for natural islands (NCWRC). The shape of a dredged material island is probably of little importance to nesting terns as long as the site has suitable conditions for nesting terns.

Shoreline stabilization

Shoreline stabilization is not recommended for islands or beaches that will be created or restored for nesting terns. Royal and Sandwich tern chicks usually form a crèche 2-3 d after hatching and prefer access to the water's edge (Shealer 1999, Buckley and Buckley 2002). Chicks of other tern species sometimes move to the water's edge prior to fledging (Parnell et al. 1995, D. Allen and W. Golder, pers. obs.). If an island is stabilized with sand bags or rip-rap, tern chicks may attempt to make their way to an intertidal beach during low tide and then be swept away during high tide or by large boat wakes. Tern chicks may tumble into crevices of a rip-rap stabilized shoreline. Stabilization with submerged, emergent, or upland vegetation presents a different set of problems for nesting terns. Planting vegetation will likely increase the rate of plant succession on an island, thus reducing the useful life for nesting terns. Vegetation can attract nesting gulls, which can become significant predators on nesting terns and may cause terns to abandon an otherwise suitable nesting site. Stable vegetation may attract predatory and non-predatory mammals, which may be able to overwinter on an island.

Lastly, the presence of submerged and emergent vegetation may jeopardize the ability to deposit new sand on a site, thus jeopardizing the maintenance of a site for nesting terns.

Management and Monitoring

Most dredged-material islands require active management to be suitable for nesting waterbirds. While these islands are often remote and only accessible by boat, they can become popular areas for passive and active recreational activity, especially those located near population centers. These activities often peak during the warmer months of the year, which typically coincides with nesting activity by waterbirds. Therefore, dredged-material islands require active management and regular monitoring to prevent or discourage human disturbances. With each dredged-material island supporting or potentially suitable for nesting waterbirds, there should be a management, monitoring,

and maintenance plan developed and implemented by an appropriate agency or non-governmental organization with demonstrated experience in waterbird management.

Succession and Useful Life of Habitat

Dredged sand islands undergo a predictable pattern of plant succession, which largely determines the habitat available for nesting waterbirds and the suite of waterbird species that may use a particular island. Parnell and Soots (1975) mapped plant succession on undiked dredged sand islands along the North Carolina coast (Figure 1).

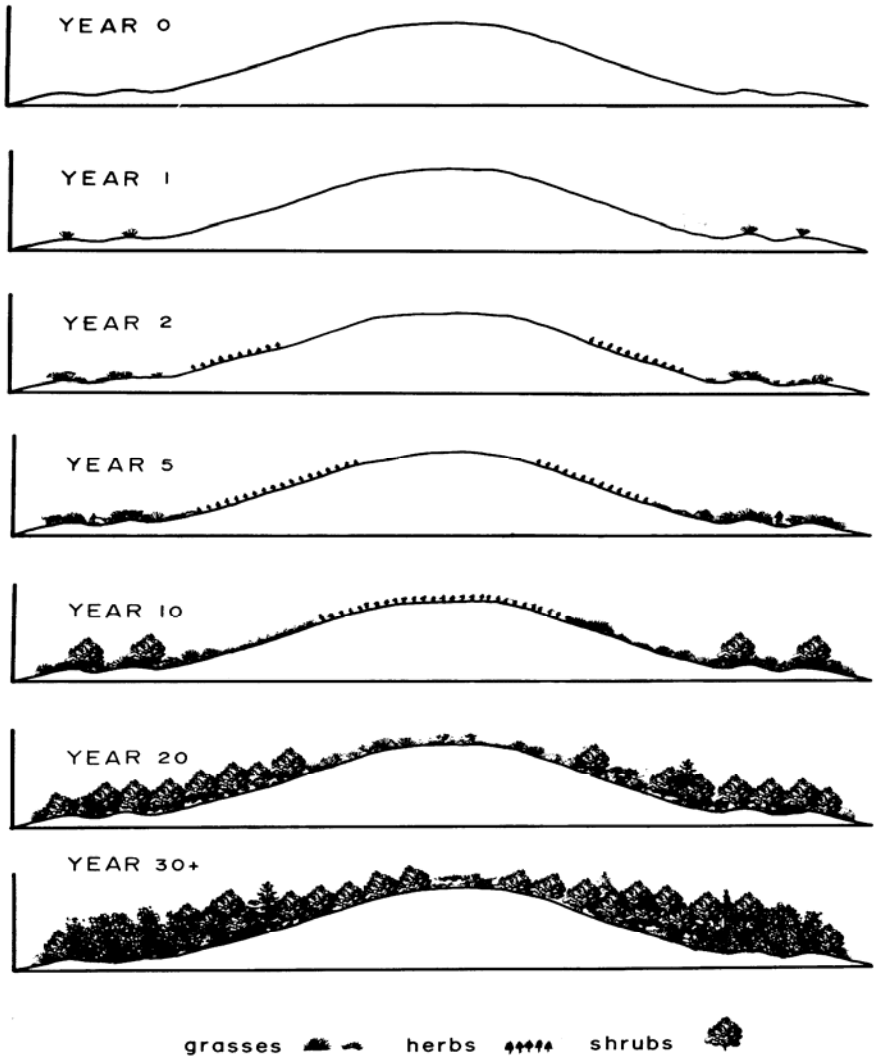

Figure 1. Plant succession on dredged-material islands (Soots and Parnell 1975).

The use of dredged sand islands by nesting waterbirds follows a similar and predictable pattern. New deposits of dredged sand are typically occupied by nesting terns and skimmers, older islands become less suitable for early succession nesters and more suitable for pelicans and gulls, and islands with shrub thickets or forest habitats are most suitable for nesting wading birds (Soots and Parnell 1975). The useful "life" of an island can vary locally and regionally, and depends on many factors that can extend or shorten the period of time an island is used. These include substrate, disturbances, predators, local environmental conditions, use by roosting cormorants or pelicans, and history of nesting waterbird use. Table 3 provides general guidelines for use of dredged sand islands by nesting waterbirds (Soots and Parnell 1975).

Table 3. Estimate use of dredged sand islands by waterbirds.

Species	**Age at first use (yrs)**	**Estimated Use (yrs)**
Brown Pelican	5	10-15
Laughing Gull	5	10-15
Royal and Sandwich tern	1-2	4-7
Gull-billed Tern	2	4
Common Tern	2	6
Forster's Tern*	3	2+
Least Tern	1-2	4
Wading Birds	10	30+

* Highly variable. Depends on presence of wrack or marsh.

Note: Adapted from Soots and Parnell (1975) and revised based on additional information not available at the time of their publication.

Timing of disposal of dredged sand is just as important as the quality of material being placed on potential nesting sites. Several factors influence timing of dredging projects. They include (but are not limited to): impact on local fisheries, presence ofendangered species (sea turtles, manatees, and others), presence of nesting birds, local weather conditions, funding, contractor availability, and condition of the dredging site.

Placing sand on potential nesting sites while birds are courting, incubating, feeding chicks, or anytime prior to all chicks fledging will cause abandonment of the site and would likely violate state and federal laws. Placing sand on sites while birds are actively nesting must be avoided. The dredging window (the period when excavation of sand by dredging and the disposal of that sand is permitted) varies throughout the region. Therefore, determination of the appropriate time for a dredging project must be handled locally. Ideally, placement of dredged sand on a potential nesting site should be completed four weeks prior to the first arrival of nesting birds. This will give the substrate time to settle and dry out prior to the arrival on nesting birds. It will also allow time for the site to be posted and other appropriate management measures to be implemented.

Opportunities for short-term and long-term waterbird habitat restoration with dredged sand likely exist at many sites along the southeastern United States coastline, especially on state and federal lands, non-governmental conservation lands, and through partnerships with private landowners. Identifying opportunities for waterbird habitat restoration on dredged sand islands should be a priority in all coastal states in the region. In some areas, existing managed habitats could be altered to provide specific habitats required by waterbirds. Existing dredged material islands that currently do not provide suitable habitats for waterbirds should be reviewed for their potential as restoration sites. Similarly, opportunities for the creation of waterbird habitats should also be explored. The use of dredged sand is one method that can be used successfully to both create and restore nesting habitats for waterbirds.

Success of waterbird habitat projects that involve depends on cooperation among regulatory and resource agencies (state and federal), non-governmental organizations, and other stakeholders that is established long before a project is initiated. To facilitate this cooperation, some states and areas within states have developed working groups or committees that meet regularly to discuss dredging, birds, project design, and other issues related to birds and dredging. North Carolina, for example, has the North Carolina Colonial Waterbird Management Committee and representatives from resource agencies actively participate in USACOE District dredging coordination meetings. Tampa Bay

has a Migratory Bird Protection Committee to discuss, among other things, issues related to dredging and birds.

Recommendations:

1. ***At least 1km of open water, preferably with a deep channel and tidal flow, separating a potential nesting site from mainland or other predator source is sufficient to reduce the chance of both predators and people visiting the site.***
2. ***Construction of permanent dikes around sites created or restored for nesting waterbirds should be avoided. Undiked islands and those where control of effluent method of disposal is used are preferred.***
3. ***Disposal of dredged material on islands should be conducted outside of the nesting season and should be completed at least 4 weeks prior to the arrival of nesting birds.***
4. ***A gentle slope of 100:3 is desirable for ground-nesting waterbirds and no slope on the island should be greater than 3:1***
5. ***A long-term management plan should be developed and implemented on all sites where dredged material is used to create or restore habitats for nesting waterbirds and the management plan should be implemented by an appropriate agency or organization with demonstrated experience in waterbird management.***

Depredation Control

Since all colonial waterbirds, other than Cattle Egret, are fish-eating species, many of these species are in conflict with economic and other interests associated fisheries, both recreational and commercial. In addition, when colonies (including especially Cattle Egrets) form in residential areas and near airports, safety and health issues need to be considered. All together in the Southeast Region, colonially nesting waterbirds receive much attention from the standpoint of depredation authority under the Migratory Bird Treaty Act, and permits are issued to authorize lethal take of thousands of colonially nesting waterbirds annually. The potential impacts on populations from depredation permits are analyzed in here and based on these, promoting populations in a given area to decrease a category are recommended (the third type of objective listed above in the **Population Objectives** section in the main text). The management recommendations for reducing conflicts with human interests, and reduction objectives for diminishing conflicts and ultimately reducing take under depredation permits, are also discussed below.

The U.S. Fish and Wildlife Service is the federal agency responsible for conserving and protecting national populations for present and future generations. The Service is responsible also for working with the U.S. Department of Agriculture Wildlife Services (USDA Wildlife Services) and State fish and wildlife agencies to devise safe and effective ways to reduce existing conflicts. The Service uses a "depredation permit" process that enables both conflicts and conflict resolution strategies to be identified and acted on after assessing the biological implications to the depredating species. The issuance of a depredation permit allows the permit holder to take action against nuisance birds by either killing or otherwise removing them, but only after the damage has been documented and certified by USDA Wildlife Services, with all reasonable non-lethal measures proven ineffective. The Federal regulations pertaining to the issuance of depredation permits, are found in the Code of Federal Regulations (50 CFR Subpart D Control of Depredating Birds).

Aquaculture and Fish-Eating Birds

Cultivation of farm-raised catfish and crawfish for public consumption, baitfish for anglers and commercial fishing operations, and tropical fish for the pet trade all have undergone tremendous expansion since the 1970s. This expansion is happening at the same time many fish-eating bird species are recovering from low population levels caused by habitat loss and widespread pesticide use prior to 1970. In some areas aquacultural activities provide an abundant food source for fish-eating birds. While some believe that the increase in populations of fish-eating birds is due solely to greater prey availability, the majority of fish-eating birds are simply returning to former breeding or wintering areas, while taking advantage of available food. Although there are some serious conflicts involving economic losses due to fish-eating birds, actions to reduce conflicts must be implemented with the understanding that the southeastern environment is important for supporting both aquaculture and fish-eating birds.

Presently, a Depredation Order for Double-Crested Cormorants at freshwater aquacultural facilities is in effect which allows lethal control without a depredation permit at private and State operated facilities. This Depredation Order covers all States in the Service's Southeast Region (as well as Texas, Oklahoma, and Minnesota) where

USDA Wildlife Services has certified that non-lethal approaches alone are not effective in alleviating economic losses. Permits for lethal control of other fish-eating species may be issued, again based on certification from USDA Wildlife Services and the removal process being biologically sound. In addition, the Service has a Director's Order in effect allowing lethal control of cormorants without a permit that may be impacting resources at public fish hatcheries.

Recreational Fishing, Double-crested Cormorants, and other Fish-Eating Birds

Declines in some recreational fish populations in the Great Lakes and Northeastern U.S. have been suspected of being bird-caused. Similar suggested declines in managed reservoirs of the Southeast have gained national attention. Among fish-eating birds, Double-Crested Cormorants receive the most attention as a suspected culprit in the decline of recreational fisheries. A review of all relevant studies to date suggests that under rare circumstances large cormorant populations could impact some local fisheries. This impact may be negative in some cases, where certain age classes for a sport fish may be reduced to the point of affecting overall recruitment. In other cases the effect may be positive when consumption of mostly overabundant forage fishes may reduce competition with the younger age classes of sport fish.

The status of recreational fish populations and increasing populations of fish-eating birds is at best complex, but there is little support for the suggestion that cormorants, or any other fish-eating species, are responsible for widespread declines in recreational fish populations. Nevertheless, local problems may exist and the Service supports appropriate studies to document actual conflicts between fish-eating birds and recreational fish populations, as well as other natural resources of interest, in order to take the most appropriate course of action to alleviate the conflict.

Double-crested Cormorant National Management Plan and Environmental Impact Statement

In addition to aquaculture and recreational fishing concerns, other possible impacts from cormorants may occur. Potential effects on threatened and endangered species, other migratory birds, vegetation, and other natural resources and socioeconomic factors

has led the Service to develop a Public Resources Depredation Order which is now in effect for allowing lethal control of double-crested cormorants where documentation exists that suggest Public resources are being impacted by cormorant populations. Refer to the Service's migratory bird website for more details on this Order:

http://migratorybirds.fws.gov/issues/cormorant/cormorant.html .

Service Guidelines Regarding Issuance of Permits for Depredating Fish-Eating Birds in the Southeast Region

The Migratory Bird Treaty Act allows the Service to permit lethal control through removal of nests with chicks and eggs, or shooting of migratory birds, such as fish-eating species, to control depredation. Lethal control of depredating fish-eating birds may be authorized, but only after certification by USDA Wildlife Services that (1) a damage problem exists and (2) non-lethal measures have proven ineffective. In addition, the Service determines (1) that no threatened or endangered species are involved and (2) the population status of the depredating bird species is secure. The following Southeast regional guidelines are presented here to help determine under what conditions a depredation permit would be considered by the Service:

Aquaculture Facilities

To remove depredating double-crested cormorants at a freshwater aquacultural site, or private and public hatchery facilities, a permit is not required because they fall under either the Aquacultural or Public Resources Depredation Orders, or the Director's Order, as described above, covering all States in the Service's Southeast Region. For all other fish-eating bird species, private facilities may be issued a depredation permit if significant economic harm is documented by USDA Wildlife Services, and the removal process is biologically sound.

Public Waters

Permits may be issued to ensure survival and recovery of State and Federal threatened and endangered species when supported by an approved recovery plan and when all other management solutions have

proven ineffective. Consideration also will be given to issuing permits to alleviate depredation or damage to for rare and declining plant communities and animal species of conservation concern, or other species such as recreational fishes. However, issuance of depredation permits only will be considered after the development of a comprehensive management plan (approved by an appropriate natural resource management agency) identifying fish-eating birds as a major limiting factor for managing sustainable populations.

Private Waters:

Permits may be issued if a commercial (fee-only) operation is being affected, which has confined fish in a way that maximizes fishing opportunities for patrons (may include homeowner associations). Permits also may be issued for significant property damage (for example, to physical structures) or when significant impacts to vegetation are evident at private lakes or in uplands where nesting colonies or roosts are located.

Fish-stocking Sites for Public and Private Waters

Permits may be issued to take depredating birds at the site of stocking if all other management solutions have proven to be ineffective, but requests for permits will not be considered for free-swimming fish beyond the site of stocking.

A white paper summarizing authorized and reported take under depredation permits is included below.

Summary of Authorized and Reported Take of Colonial Nesting Fish-eating Birds from 1990 to 2002 within the Southeast U.S.

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This paper represents a summary of authorized and reported take for colonial nesting birds to alleviate depredation conflicts among Southeastern States included within the Southeast Region (Region 4) of the U.S. Fish and Wildlife Service (FWS) from 1990 to 2002. State waterbird biologists were first queried as to their best estimate of nesting pairs for each species and these numbers were then multiplied by 3 to represent two adults and an average of one fledgling per pair each year. Numbers of birds authorized for take were compiled based upon requests provide to the FWS Migratory Bird Permits Office in Atlanta, GA from U.S.D.A. Wildlife Services' State Offices. Numbers of birds reported taken were based on reports from permittees submitted yearly to the FWS Migratory Bird permits Office. All permit summary data used for this report are available upon request from the senior author.

The purpose of this exercise was to determine the relative level of authorized and reported take that may impact breeding populations of any species in any State and to determine if there may be differences among states in the numbers of authorized or reported birds. A threshold percentage for suggesting a closer look at population impacts may be warranted for both authorized and reported birds was 5% of estimated State breeding population (again, number of breeding pairs multiplied by 3). This threshold if reached or surpassed consistently from one year to the next does not imply that viability of a population is in question, but only should be interpreted that a closer look at the effects of depredation control on populations may be warranted. For those species where less than 5% of a breeding population is authorized or reported taken consistently from one year to the next, we are assuming there is no impact to that population.

Several caveats should be kept in mind when reviewing this summary. These are (1) low reliability on exact estimates from most states, but estimates are all considered close to actual population sizes based on expert opinions, (2) many birds are subject to

being taken during the winter when populations of some species breeding to the north of the Southeast Region may inflate state breeding populations to an unknown extent, and (3) we assume the number of birds reported taken are correct (they may not be).

With these caveats in mind:

For Alabama: Snowy Egrets in three years authorized take exceeded 5%, but reported take equaled 5% of estimated breeding population for only 1 year.

For Kentucky: Great Egrets authorized take equaled 5% for one year, but there has been no reported take for any year.

For Mississippi: Snowy Egrets from 1990-1998, authorized take exceeded 5% each year, but dropped below 5% since 1999; reported take for 3 years was 1/3 to 1/2 of estimated breeding population, but has dropped to near zero since 1999.

For Mississippi: Great Egrets from 1995-2002, authorized take exceeded 5% each year, but reported take never exceeded 5%.

For Mississippi: Great Blue Heron from 1995-2002, authorized take exceeded 5% each year, but reported take exceeded 5% in only two years and not since 2002.

For Tennessee: Great Egrets for two years, both authorized and reported take equaled 5%, but both have been at zero since 1994.

For all species in the States treated above, the data suggest that there is no long term effect from issuing depredation permits and there is not a need for further analysis, except to continue checking for changes to the above patterns at the end of each reporting year.

For Arkansas, a high percentage of species were found with authorized and reported take exceeding 5% of the State's estimated breeding population and so is treated separately here.

Snowy Egret: An average of 31% of the estimated number of Snowy Egrets are authorized each year (range 12-61%). An average of 16% are reported taken (range1-33%), but this number has dropped below 5% since 1998.

Great Egret: An average of 10% are authorized each year (range 8-46%) with an increasing trend since 1998. An average of 21% are reported taken (range 4-21%), with an overall increasing trend since 1990.

Great Blue Heron: An average of 15% are authorized (range 8-28%) with an increasing trend since 1990. An average of 15% are reported taken (range 5-15%) also with an increasing trend since 1990.

Anhinga: Authorized take for two years ranged to 19% of an estimated 300 individuals

thought to occur in the State. Actual take in both years was 7%, but no activity since 1991 involving this species.

Little Blue Heron: An average of 24% are authorized (range 14-42%) with an increasing trend since 1990. An average of 9% are reported taken (5-12%) with a irregular pattern since 1990.

Tricolored Heron: Take for this species was authorized in 2002 at 152% of the estimated population, but none have been reported taken.

Of the species involved above, only the **Little Blue Heron** has been identified as a Bird of Conservation Concern (FWS 2002), on the American Bird Conservancy's Greenlist, (Chipley et al. 2002), and of Continental Concern in the Southeast U.S. Waterbird Conservation Plan (Hunter, Golder, Melvin, and Wheeler, in prep.), in large part because this species is the only species treated here that is undergoing steep declines through much of the Southeast, including in Arkansas. It may be prudent to more closely scrutinize permit requests that involve this species.

In addition, most migrant **American White Pelicans** authorized (~1600-2700, from 2000-2002) and reported (~550-750) taken from the Southeast are from Arkansas. Given an estimated global population of 180,000 total individuals this equates to 2% of the global population authorized and up to 0.5% reported taken during each of the last 3 years in Arkansas alone.

For Arkansas, it is apparent that there are major differences when compared to other States in numbers of birds authorized and reported taken. Are these differences due to differing levels of conflict or in differences in how conflicts are perceived between Arkansas and the other southeastern States. A closer look as to what is happening in Arkansas appears warranted. Much of the reported reasons for depredation permits involve aquaculture, but also some health and safety associated issues involve nesting colonies in developed areas, etc.

Literature Cited

Chipley, R. M., G. H. Fenwick, M. J. Parr, and David N. Pashley. 2003. The American Bird Conservancy Guide to the 500 most Important Bird Areas in the United States. Random House, New York.

Appendix 3 – Conservation Partners

Needs Input

Joint Ventures

Joint Ventures (JVs) are established regional entities formed under the North American Waterfowl Management Plan in Canada, the U.S. and parts of Mexico. They consist of voluntary organizational and agency partners working together to conserve bird habitat, traditionally wetlands of importance to waterfowl. Recognizing the effectiveness of the JV approach to conservation, JVs are accepting the challenge of implementing plans for all groups of birds. As they expand beyond their traditional focus on waterfowl, JVs are well positioned to perform on-the-ground conservation activities, particularly habitat protection and restoration, for waterbirds.

Three JVs exist in the Southeast U.S. region: the Gulf Coast Joint Venture, Lower Mississippi Valley Joint Venture, and the Atlantic Coast Joint Venture. The Gulf Coast Joint Venture (GCJV- http://www.fws.gov/southwest/gulfcoastjv/Default.htm) is divided geographically into six initiative areas along the coast of the Gulf of Mexico in the states of TX, LA, MS and AL. With a different mix of habitats, management opportunities, and species priorities, each initiative area has an individual implementation plan with goals, objectives, and conservation strategies. Delivering waterfowl objectives is still very much the focus of the GCJV, however, the JV is exploring how to increase its capacity to address other birds. A first step towards integrating the needs of waterbirds might be to analyze how the objectives for waterfowl habitat in the implementation plans for the six initiatives compare to the habitat objectives identified in this plan.

The Lower Mississippi Joint Venture (LMJV) has as its geographic scope the Mississippi Alluvial Valley BCR and the West Gulf Coastal Plain BCR, and has as its biological scope includes strategic planning and implementation for "all birds in all habitats." LMVJV partners have organized their institutional capabilities and personnel expertise to plan and deliver landscape-scale integrated bird conservation. Specifically, for waterbirds, they have/intend to develop… EXPLAIN PROGRESS ON:

- Habitat objectives expressed at multiple scales linked to regional and continental bird populations based on testable assumptions regarding limiting factors.

-GIS decision support models and conservation planning tools.

-Habitat and population tracking and monitoring programs.

-Focused research applying the principles of adaptive resource management.

-Habitat delivery programs that have helped to restore, enhance, or protect over 1-million acres of important wildlife habitat.

The Atlantic Coast Joint Venture (ACJV) stretches the length of the Atlantic Coast, overlapping with the Southeast Coastal Plain BCR to the JV boundary west of the Alabama and Georgia border. For this area, as well as marine waters of the Southeast U.S. Continental Shelf (BCR 77) and the near shore waters of the Gulf of Mexico pelagic (BCR 74), the ACJV has undertaken an in-depth integrated conservation planning effort as part of the South Atlantic Migratory Bird Initiative (SAMBI). The SAMBI Steering Committee brings together JV Management Board members from the five states involved in the initiative, and numerous technical personnel in the form of State Working Groups and an overall Technical Committee. The SAMBI Implementation Plan was recently approved by the ACJV Management Board, and provides the framework in which the recommendations of this Plan will be addressed under SAMBI. The goals presented in the SAMBI Implementation Plan draw on the information developed for this Plan, including population and habitat objectives, and priority species and habitats, as well as focal areas and some State-specific objectives identified by State Working Groups. The SAMBI approach to conservation involves taking a landscape-scale view of habitat, including Important Bird Areas, the network of protected lands, focus areas and land cover, in designing where to undertake specific conservation actions and strategies. The SAMBI plan also lays out non-habitat based conservation strategies and priority research and monitoring needs necessary to achieve its goals.

The SAMBI Implementation Plan describes how this Plan will be implemented in the relevant portion of the Southeast Coastal Plan and adjacent waters. As information for future versions of this Plan becomes available, efforts under SAMBI will be adjusted accordingly. Conversely, the progress of SAMBI will inform and improve conservation strategies for the entire SE U.S. Region.

Private Landowner Programs

The key in this Region is in facilitating conservation on private lands because a vast amount of waterbird habitat in the Southeastern U.S. Region is in private ownership. Various states have lands programs for private lands. Need to establish incentives for private landowners. The Wildlife Habitat Incentive Program to improve wildlife habitat -- NRCS USDA addresses land not presently in production, but lacks funds. Texas has a landowner incentive program that addresses management of rare resources on private lands. Some of this funding is spent on restoring native habitats that might be beneficial to colonial waterbirds.

State-led Programs

Most states in the Region have nongame coordinators or biologists who are involved with colonial waterbird conservation and research. Huge areas of colonial waterbird habitat are under state ownership and natural resources management. Principle delivery mechanisms. States in the Region have been tasked with developing Comprehensive Wildlife Conservation Plans which outline priority conservation needs. These Plans will be used to direct future Federal funding toward state wildlife agencies in the form of state grants.

Federal Partners and Programs

Wildlife Services Lab - Since 1990, monitoring cormorants in roosts, since 1996 in Al and 1998 in MS, AR. Aerial survey data on white pelicans for five years in s LA and MS Delta region. Not much done with wading birds. In 1990 and 1996 there were surveys of wading birds at catfish ponds in MS delta.

Waterfowl Management Programs – There is an existing infrastructure for waterfowl management?? Federal or cooperative?.

The Fish and Wildlife Service has migratory bird coordinators and huge areas also federally owned. Texas Coastal Program...

Wetland Reserve Program - WRP system is an important infrastructure. Each site is inspected every year by NRCS so this is a system in place to communicate with land owners.

Corps of Engineers– COE is a critical partner in colonial waterbird conservation. The Corps' activities need to be integrated into colonial waterbird conservation, especially the creation andmanagement of spoil islands. COE sporadically monitoring Least Terns on Arkansas River.

Nongovernment Organizations

There is a strong non-government organization (NGO) involvement in conservation in the Region.

The National Audubon Society was the first to protect colony sites, and still has responsibilities on the Florida Gulf Coast.

The Natural Conservancy leads the conservation efforts on the Virginia Barrier Islands and at Pea Patch Island.

National Audubon Society – human power for monitoring. IBA (described)

Ducks Unlimited has both its international headquarters and a regional office in the region and has taken on large habitat restoration projects.

Texas Colonial Waterbird Society